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$$\left\{\begin{array}{l} x=a \text{ or } 0 \text{ or } \dfrac{a}{1-\sqrt[3]{m\div n}} \\ \text{and } y=0, \end{array}\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots(7).$$

From (5) and (6) $\dfrac{n(a-x)}{mx}=\dfrac{n[2y^2-(a-x)^2]}{m(x^2-2y^2)}$, and $y^2=\dfrac{x(a-x)}{2}$......(8)

Instead of finding second differential coefficients, substitute from (7) in (1), $x=a$ and $x=0$, make $n=\infty$. $x=\dfrac{a}{1-\sqrt[3]{n\div m}}$, makes $n=0$.

We can show that (8) does not produce any new condition for a maximum. To make y real x is not <0 nor $>a$.

If $x=a$ or 0, we have the values found in (7). Now for any value of x between 0 and a, y in (8) is seen to be finite, and n in (1) is also finite.

So $x=a$ or $x=0$ with $y=0$, producing the only infinite values of n indicate the positions of maximum intensity of illumination to be directly in front of either light.

PROBLEMS.

59. Proposed by MOSES C. STEVENS, M. A., Department of Mathematics, Purdue University, Lafayette, Indiana.

Solve $n\dfrac{d^2y}{dx^2}(x^2+y^2)^{\frac{1}{2}}=\left[1+\left(\dfrac{dy}{dx}\right)^2\right]^{\frac{3}{2}}$.

[*From Forsyth's Differential Equations.*]

60. Proposed by SETH PRATT, C. E., Assyria, Michigan.

To remove $(1/a)$th of the volume of a sphere of a given radius by a conical hole, whose axis is the axis of a sphere, and whose vertex is at the surface of the sphere. Required the height of the cone and the diameter of its base.

AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

NOTE ON PROBLEM 26.

After carefully reading Dr. Martin's "Reply to Replies on Problem 26," we see no reason for changing our opinion respecting the solution we have been defending. We may, however, be led to agree with Dr. E. H. Moore, Dr. William

Hoover, and Prof. Henry Heaton, that there is no *correct* solution of the problem. That is to say, in so much as the problem is stated in the indefinite form, a solution taking any one of the elements of a triangle of which the area is a function will lead to a correct result. But it does seem to us that this statement, while it is true in general, does not apply in this case. It was asked of us during the summer whether anyone had sent in a solution assuming the altitude as the variable. Now we think it is quite clear that a solution which assumes the altitude of the triangle as the variable can, in no way be correct, for the solution would include not only right triangles, but oblique triangles as well. The result is

$$2\int_0^{\frac{1}{2}a} \tfrac{1}{2}apdp \div \int_0^{\frac{1}{2}a} dp = \tfrac{1}{4}a^2, \text{ where } p \text{ is the altitude.}$$

But if p is made a function of the angle at the center of the circle subtended by a side, the result will be $\frac{a^2}{2\pi}$. We think, however, that this controversy has been carried on long enough, and therefore it is desirable that it close without further discussion. EDITOR.

NOTE ON PROBLEM 29.

BY HENRY HEATON.

When the points to which r is measured are distributed symmetrically with respect to the minor axis the different radii vectores may be arranged in pairs such that the sum of the lengths of each pair will be $2a$. Hence, using Dr. Hoover's notation, m'' and m''' each equal a. m''' may be shown to equal a by the calculus, thus :

$$r = a - ex,\ d\theta = \frac{(a^2 - e^2a^2)^{\frac{1}{2}}\,dx}{(a^2 - x^2)^{\frac{1}{2}}}.$$

$$\text{Hence } m''' = \int_{-a}^{+a} \frac{(a - ex)(a^2 - e^2x^2)^{\frac{1}{2}}\,dx}{(a^2 - x^2)^{\frac{1}{2}}} \div \int_{-a}^{+a} \frac{(a^2 - e^2x^2)^{\frac{1}{2}}\,dx}{(a^2 - x^2)^{\frac{1}{2}}}$$

$$= a\int_{-a}^{+a} \frac{(a^2 - e^2x^2)^{\frac{1}{2}}\,dx}{(a^2 - x^2)^{\frac{1}{2}}} \div \int_{-a}^{+a} \frac{(a^2 - e^2x^2)^{\frac{1}{2}}\,dx}{a^2 - x^2} = a.$$

A fourth very obvious case of this problem is when the distances are measured at equal intervals of time.

$$\text{Then } m'''' = \int rdA \div \int dA = \int_0^{\pi} \frac{r^3}{2}\,d\theta \div \int_0^{\pi} \frac{r^2}{2}\,d\theta$$

$$= \frac{a^2(1 - e^2)^3}{b\pi} \int_0^{\pi} \frac{d\theta}{(1 - e\cos\theta)^3} = \frac{a^2}{2b}\left(3(4 + e^2)(1 - e^2)^{\frac{1}{2}} - 10(1 - e^2)^2\right).$$

Corollary. Let $e = 0$, then $m'''' = a$, as it evidently should.